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NOTES ON MIRANDA AURANTIA.

BY F. WENNINGER.

Miranda Aurantia is the large, yellow garden spider, common in summer and early autumn. The specimens that furnished the matter for the observations recorded in this paper were collected during the summer and early autumn of 1916 and 1917. In August and September, 1916, the species was found in greatest abundance along the shores of the St. Joseph River in the triangle formed by the river, St. Mary's road and the Michigan Central tracks. The ground around the two lakes at Notre Dame was explored with this result; the species was found quite abundant along the north shore of St. Mary's Lake, there were comparatively few spiders of this species along the south shore, and only an occasional specimen along St. Joseph's lake. An hour's collecting along the St. Joseph River in August, 1916, yielded about two hundred and sixty specimens, suitable for laboratory purposes. During the corresponding season of this year, 1917, a marked decrease was noticeable in the number of desirable specimens along the River, though the number of spiders around the lakes near the University appeared to be about normal. This year, what seems to be a new and isolated colony was found on a plot of ground adjoining the University athletic field, a distance of, perhaps, four hundred yards from the nearest lake. Some of the largest spiders had built their webs and nests here, near *Agelena nevia* and some species of *Epeiridae* and *Therididae*. One should expect to find the species distributed rather generally along the fields connecting this outpost with the central colony along the lakes. But the fact did not warrant this expectation.

Miranda Aurantia has been known to science since 1833. The following table, taken from Nathan Banks,[1] gives a fairly complete list of the names under which the species has been described:

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[1] Nathan Banks in U. S. Museum Bulletin, Vol. 72, p. 46.

Argiope Aurantia, Lucas; 1833,
Argiope vestita, Koch, 1839
Argiope riparia, Hentz, 1847
Argiope riparia, Emerton, Conn. Acad. 1884.
Argiope sutrix, Hentz 1847
Argiope multiconcha, Treat, Am. Nat, 87. p. 1122.
Argiope Cophinaria, McCook, Am. spiders, '94, p. 217.
Argiope personata, Cambridge, Biol. Cent. Am. Arach., 1, p. 10, '90.
Argiope Godmani, Cambridge, Biol. Cent. A,. Arach., 1, p. 336, '98.
Miranda Aurantia, Comstock, Spider Book, p. 434, 1912.

The question of priority of nomenclature has not received much attention. Authors that mention the species seem to fix on the name that they consider correct and use it without, in most instances, a reference to other names. The species has been known most commonly under the name, *Epeira riparia,* given to it by Hentz in 1847, and under the name *Epeira cophinaria,* given to it by Walckenaer in 1837. But as early as 1830, Lucas had described and figured the species as *Aurantia.* This name, therefore, has the claim of priority. As to the generic name, this is to be said: *Argiope* is undoubtedly the older name, but, for many reasons, the best of which is to be found in a very desirable rearrangement of all allied genera, F. O. Pickard–Cambridge in the Biologia Central Am., separated the genus *Miranda* from the genus *Argiope.* The best modern scholarship, therefore, seems to indicate that the name *Miranda Aurantia* is to be preferred.

The average adult female of the species has all the general characteristics of the order *Araneida.* The cephalothorax is nearly as wide as long, and is covered with silvery white hairs except around the eyes. The abdomen is oval, a little pointed behind and square in front, with two small humps at the corners. The ground color is black marked with bright yellow or orange spots. On each lateral margin of the abdomen, the yellow spots form an almost continuous band. There is a black band between these two rows of spots, and in this there are from one to three pairs of yellow spots. In most of the specimens examined by the writer, two pairs of spots were found. The color of the ventral side is black, with a yellow stripe on the sternum, and two rather wide yellow stripes on the abdomen with small yellow spots between and at the sides.

The male differs considerably from the female. It is much smaller, being only about one fourth as long as the female. There is a pair of palpi that attract attention on account of their size. The abdomen has a broad band of brown along the middle of the back, and on each side there is a band of white.

The body of the young spiderlings, is quite slender, and, while still in the egg-sac, shows hardly any differentiation of color. But soon after they emerge they begin to show color characteristics. The ground-color is pale brown or black and the markings are gray instead of the strong yellow and black of the adult. The legs are marked at the ends and in the middle of each joint with dark rings.

The anatomy of the species, both external and internal, is that common to all true spiders. These notes, therefore, will indicate only those structures wherein *Aurantia* differs from the type.

The term "areas" of the head" is used by some authors. But since there are no sutures to limit spaces, this terminology seems to have only a questionable practical value.

The "eye-space"—that area of the head bounded by a line drawn around the eyes—is quite small in this species. In form, it might be described as trapeziform.

The eyes of this spider are all simple. They are eight in number, and there are no facets. They are the so-called diurnal eyes; nocturnal eyes are lacking. In arrangement, they are so separated as to occupy nearly the whole width of the head.

The eyes are not elevated and, hence, the "ocular tubercle" is absent.

The chelicerae are short and stout, and consist of a basal segment and a terminal claw. The lateral condyles seem to be wanting. There is, however, a furrow in the basal segment, armed with a row of teeth.

The next departure from the anatomy of the type occurs in the legs. The usual seven parts are present and are easily distinguishable,—coxa, trochanter, femur, patella, tibia, metatarsus and tarsus. The claws are outgrowths from the terminal portion of the leg, called the pretarsus. They are composed of many hypodermal cells. In *M. Aurantia*, the pretarsus seems to be a distinct segment. There are three claws on each tarsus. Two of these claws are placed side by side on the upper surface of the pretarsus, while the third is below; the whole arrangement is triangular in form. The upper, or paired claws, have a series of teeth. The third claw is just perceptibly smaller than the other two, and has also a number of teeth; but these are finer and fewer than in the other claws. In addition to these claws there are also six accessory claws.

The tip of the tarsus is usually armed with terminal tenant hairs. These seem to be entirely wanting in the species for of all the specimens examined by the writer, only one specimen showed structures approximating this even remotely.

The calamistrum is the hackle for the formation of the "hackle band" characteristic of the web of this spider. It is composed of several rows of curved spines on the upper margin of the metatarsus of the hind legs.

In the abdominal region, the following peculiarities are to be noted: there is no *pedical* and no *folium* in the species. Muscle impressions—small, hardened points indicating the place of attachment of the muscles to the body wall—are present in *M. Aurantia.* The dorsal surface seems to bear two pairs of muscle impressions, while an unpaired one appears near the base of the abdomen.

There are two kinds of spiracles in *M. Aurantia.* One kind is the lung-slits; and there is at least one pair of these. The other spiracles are the tracheal spiracles, situated in front of the spinnerets. Of these there is only one.

The *epigynum* of *M. Aurantia* is a complicated organ. The chitinous plate is depressed and furrowed longitudinally, and the depressed area is divided by a ridge-like elevation which marks the depression off into two furrows or channels, each leading into an opening of the spermatheca of the corresponding side.

There are four spinnerets having two segments each, and one, the hind spinneret, having four segments. The sides of these organs are firm, but the terminal portion, constituting the spinning field, is membraneous. This latter portion is surrounded by two kinds of hairs, simple and barbed. The number of spinning tubes is very great—a hundred on each spinneret would probably be a conservative estimate. *Aurantia* spins silk of three colors. White silk forms the web, the bands for securing captured prey, and the egg-cocoon; brown silk forms the interior of the egg-sac; yellow silk forms a kind of buffer between the eggs and the outside covering. The glands that secrete this silk are numerous and of several kinds. The most numerous are the aciniform or berry-shaped glands. Comstock has determined by experiment that the function of these glands is the manufacture of the silk for the swathing band. The *pyriform* or pear-shaped glands are present in large numbers. Their function is the production of silk for the attachment disks. The *ampullae* glands produce the silk for the formation of "drag-lines" in the net. These are not numerous. *Cylindical* glands are present in small numbers. They produce the silk from which the egg-bag is made. There are two poison glands that discharge their contents through a long slender duct that opens near the tip of the claw of the chelicera. Glands that are lacking in *Aurantia* are: aggregate, lobed and cribellum glands.

The eggs of *M. Aurantia* are laid in a mass protected by two layers of silk and enveloped in a waterproof bag. Most of these egg-sacs are attached to thistles or milkweed or golden rod. But many were found attached to such objects as cast-off window screens, pieces of timber projecting from lumber piles, discarded fence-posts, and some were fastened under the eaves of an old barn. The egg-sac is about the size of a hickory nut—the average diameter of observed specimens was about 22mm. The size was constant in a very large majority of cases. But some egg-sacs measured 30 mm. and a few only 15, or even 12 mm. in diameter. The average egg-sac contains about a thousand eggs. But some have only a little more than five hundred, and a few were found that contained about eight hundred. The reason for this is not clear from observation, and there is none given in the literature of the subject as far as it has come under my notice. A difference of twenty or fifty could easily be traced to individual peculiarities. But a difference ranging from two to five hundred in the same species seems to need a more substantial explanation than individual peculiarity or fertility.

The eggs hatch in a short time—about two weeks for specimens observed in this locality. But the spiderlings remain in the egg-sac until the following spring. While still enclosed in the sac, they develop those canabalistic tendencies that are remarkable in the adult. An egg-sac of this species opened on September 17, 1916, contained 1018 live spiderlings, and about 200 remains of their weaker companions that had succumbed to the canabalism of the stronger spiders.

It is certain that *M. Aurantia* sheds its outer layer of the cuticula. I have found the molts from time to time, but have been unable to determine thus far, how often this happens. Exact observations on this point do not seem to have been made, or if made, have not been recorded in the literature on the subject to which I have had access.

The food of *M. Aurantia* consists chiefly of insects. But spiders will eat other spiders, and, after the pairing season, the female usually devours the male. In September, 1917, a male and female were brought to the writer's laboratory. The collector had put them into a pill box. When the box was opened, the male was found tightly wrapped in his shroud, and the female had already begun her meal. The staple article of food of *M. Aurantia* seems to be grasshoppers. These are swathed in a wide band of silk and then rendered palatable by the injection of some venom through a bite with the spider's chelicerae. Other insects of many species are devoured with avidity, even such large species as dragon flies and butterflies. The following is a list of insect remains found in the webs of this species during the months of August and September, 1916 and 1917: *Libellula basalis, Libellula pulchella, Argia violacea, Annosia plexippus, Helophilus latifrons, Euschistus variolarius, Sympetrum rubicundum, Mesothemis simplicicollis,* katydids and weevils.

The process of swathing a captured insect is interesting. To observe this at close range, one has but to introduce a grasshopper into the web of a mature female. The spider will rush at the grasshopper, pierce it with the chelicerae and then dart off to safety. After a brief wait, the spider will approach the insect and, pulling out a sheet of silk from its spinnerets, with one hind leg, thrust the sheet against the grasshopper. In doing this, the spider uses first one hind leg and then the other, whirling the grasshopper around rapidly. The captive is thus securely wrapped in a tight band of silk composed of many parallel threads, and is immediately devoured or left for a more opportune time.

The task of spinning the web is begun by throwing out a thread which is carried by the air till it strikes some object and adheres to it. This line is now pulled tight and forms a kind of bridge over which the spider may travel. Foundation lines are now thrown out and these are connected by radii. The center where these radii converge is strengthened by a mesh or net-work of lines, called a hub. A characteristic structure of the web of *Aurantia* is the stabilimentum. This is a zig-zag ribbon across the center, or below the hub. It consists of a large number of minute threads resembling the swathing band, and is doubtless spun from the small spinning tubes.

The silk of this spider, as also the structure of its web, can be studied conveniently by taking a large pane of glass and passing it behind the web. By moving the glass forward and snipping off the threads with scissors, the web is transferred to the glass. This makes a suitable mount for the naked eye and microscopic study.

A word should be said about the venom of spiders. All spiders secrete poison, but only very few spiders are dangerous. I have collected hundreds of specimens of spiders, but have never been bitten. In fact, no spider even attempted to inject its venom. It is the opinion of such authorities as Comstock that in the North there is no spider to be feared while in the South there is a single easily recognized species "that is believed by some people to be dangerous." Certainly no one can justify his antipathy to the study of araneology on the ground that spiders are venomous and dangerous.

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NEW FORMS OF CALAMITES

BY N. M. GRIER

The specimens upon which this work is based were collected by Mr. Caspar Reel and myself at Reel's Stone Quarry, East Bellevue, Pa., from the sandstone above the Elk Lick Coal. They were exhibited and discussed before the Academy of Science of St. Louis, Jan. 11, 1915, and are deposited in the collection of the Academy.

EUCALAMITES.

Group of *Calamites cruciatus* Sternb.

Calamites cruciatus harrisoni, n. sp.

Pl. I., figs. 1. 2.

Internodes 23-28 mm. in length, broader than long. Articulations well marked by nodal swellings. Ribs well defined, 2-3 to 3-4 mm. in breadth, equal, half round; not alternating and generally somewhat inflated at the articulations. Furrows generally 1-3 the width of the ribs. Branch scars at least 7 to the node, 8-9 mm. in diameter, showing